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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/017,301	12/14/2001	Naoya Hasegawa	9281-4209	7249

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Chicago, IL 60610

EXAMINER

KOPPIKAR, VIVEK D

ART UNIT	PAPER NUMBER
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1775

DATE MAILED: 02/13/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/017,301

Applicant(s)

HASEGAWA ET AL. *eh*

Examiner

Vivek D Koppikar

Art Unit

1775

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 16 January 2004.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-16 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,2,7 and 13-16 is/are rejected.
- 7) ☒ Claim(s) 3-6 and 8-12 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 14 December 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. §§ 119 and 120**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☒ All   b) ☐ Some \* c) ☐ None of:  
1. ☒ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.  
a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

**Attachment(s)**

- 1) ☐ Notice of References Cited (PTO-892)                      4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)                      5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_                      6) ☐ Other:

**FINAL OFFICE ACTION**

***Claim Rejections - 35 USC § 103***

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-2, 7, and 13-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent Application Publication 2002/0034055 to Seyama in view of US Patent Number 6,462,919 to Mack and US Patent Number 6,447,689 to Tornø.

Seyama teaches a magnetoresistive sensor with a first antiferromagnetic layer (42), a pinned magnetic layer (56 and 54), a first nonmagnetic intermediate layer which is conductive (58), a free ferromagnetic layer (66, 70 and 74), a second nonmagnetic interlayer (36), a ferromagnetic layer (38 and 40) and a antiferromagnetic layer (26) on top of the ferromagnetic layer (38 and 40). A magnetization direction is pinned by the first antiferromagnetic layer (42). The nonmagnetic layer (58) and the free magnetic layer (66, 70 and 74) have a magnetic field being variable in response to an external magnetic field, and the second antiferromagnetic layer (26) magnetically couples with the ferromagnetic layer (38 and 40) to orient a magnetization of the ferromagnetic layer in a predetermined direction (Claim 9, Figure 9, Section [0006]).

Seyama does not teach a recess which extends through the second antiferromagnetic layer (26) and the ferromagnetic layer (38 and 40) in which the bottom face of the recess lies in the nonmagnetic interlayer (36).

Mack teaches a spin valve sensor with a recess which extends through an antiferromagnetic layer (222A and 222B) and a ferromagnetic layer (224 A and 224 B). The recess has a bottom face which lies on a free layer (208). This structure results in better aligned electrical contacts when the magnetoresistive sensor is read and reduced residue and shadowing (Figure 6b; Col. 4, 20-67 and Col. 8, Ln. 65-Col. 9, Ln. 12).

At the time of the invention one of ordinary skill in the art would have been motivated to construct a recess extending through the second antiferromagnetic layer (26), the ferromagnetic layers (38 and 40) and the intermediate nonmagnetic layer (36) with the bottom face of the recess lying on the free ferromagnetic layer (74) with the expectation of obtaining a magnetic sensing device which exhibits better alignment with electrical contacts when the magnetoresistive sensor is read as well as reduced residue and shadowing, as recited in Mack.

In the magnetoresistive device of Seyama in view of Mack the bottom face of the recess lies on the free magnetic layer (74) rather than a nonmagnetic interlayer.

Torng teaches a magnetoresistive sensor with a recess in which the bottom face lies on a nonmagnetic layer, seed layer (12) in this results in the prevention of the formation of multiple magnetic domains (Figure 6 and Col. 2, Ln. 29-35).

At the time of the invention one of ordinary skill in the art would have been motivated to construct a recess so that the bottom face of the recess lied on the nonmagnetic interlayer (36) with the expectation of preventing the formation of multiple magnetic domains as taught in Mack.

With regard to Claim 2, the nonmagnetic intermediate layers in Seyama consists of either Ruthenium or Copper (Figure 9).

With regard to Claim 7, the side faces of the recess in Mack are perpendicular to the track width direction (Figure 6B).

With regard to Claims 13 and 14, in Seyama the pinned layers comprise a plurality of ferromagnetic sublayers (54 and 56) separated by a Ruthenium intermediate layer (50). The ferromagnetic sublayers are made of CoFeB. The examiner takes the position that the two sublayers (54 and 56) have differing magnitudes of magnetic moments per unit area since the layer (54) is adjacent to the antiferromagnetic layer (42) while the layer (56) is adjacent to the intermediate, nonmagnetic layer (58). Furthermore, the magnetization directions of the two sublayers are antiparallel to each other because the magnetization direction of the layer (54) is in the direction of the first antiferromagnetic layer (42) while the other ferromagnetic layer (56) is adjacent to the intermediate layer (58), which is coupled with the free magnetic layer (70), which in turn is magnetized in a direction orthogonal to the magnetization direction of the pinned magnetic layer (54) (Figure 9 and Sections [0087]- Sections [0093]).

With regard to Claims 15 and 16, in Seyama the first antiferromagnetic layer (42) and the second antiferromagnetic layer (26) in Mack comprise the same antiferromagnetic material, PdPtMn. (Figure 9).

#### *Allowable Subject Matter*

3. Claims 3-6 and 8-12 objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

4. The following is a statement of reasons for the indication of allowable subject matter:

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With regard to Claims 3 and 6, the prior art of record does not disclose the specific CoFeNi alloy in which 9 to 17 percent is Fe, .5 to 10 percent is Ni and the balance is Co.

With regard to Claims 4 and 5, the prior art of record does not show an additional interlayer disposed between the free magnetic layer and the nonmagnetic conductive layer. In Seyama the free layer (66) is adjacent to the nonmagnetic conductive layer (58) (Figure 9).

With regard to Claims 8-10, the prior art of record does not teach a nonmagnetic layer between the ferromagnetic layer and the second antiferromagnetic layer. In Seyama the ferromagnetic layer (40) directly contacts the antiferromagnetic layer (26) (Figure 9).

With regard to Claims 11-12, the prior art of record does not teach a third antiferromagnetic layer which is disposed under the second antiferromagnetic layer. In Seyama there are only two antiferromagnetic layers (26 and 42) (Figure 9).

#### ***Response to Arguments***

5. Applicant's arguments filed January 16, 2004 have been fully considered but they are not persuasive.

Applicants claim that the prior art of record does not teach the concept of a magnetic sensing element with a recess extending through the sensing element in which the bottom face of the recess lies in a nonmagnetic interlayer. However the examiner would like to point out that Torng is employed precisely to teach this concept (see above rejection). The applicants do not argue against the motivation for combining the teachings of Seyama and Mack with that of Torng.

***Conclusion***

6. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).


A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

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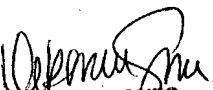
7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Vivek Koppikar** whose telephone number is **(703) 305-6618**. The examiner can normally be reached on Monday-Friday from 8 AM to 5 PM, Eastern Time.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Deborah Jones, can be reached at (703) 308-3822. The fax phone numbers for the organization where this application or proceeding are assigned are (703) 305-7718 for regular communications and (703) 305-3599 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

  
Vivek Koppikar

2/3/04

  
DEBORAH JONES  
SUPERVISORY PATENT EXAMINER